retained its red colour to the last; but when quite dry, it became of a dirty red colour.

Sulphuric acid, diluted with eight or ten parts of water, being poured upon the colouring matter, if no heat be applied, remains perfectly colourless; but, by the assistance of heat, it forms a lilac solution, which remains unaltered for a great length of time, though exposed to light; but if heat be applied, so as to evaporate part of the water, the colour is destroyed in proportion as the acid becomes more concentrated.

The effect of nitric acid is to destroy the colour in greater or less time, in proportion to the quantity employed.

Acetic acid dissolves the colouring matter, with appearances similar to those of the muriatic solution.

The solution in oxalic acid is of a brighter red than any other hitherto noticed. In tartaric acid the solution approached to scarlet.

The alkalies also, or their subcarbonates, dissolve the colouring matter; and the solutions may be evaporated nearly to dryness without losing their red colour.

The next object of Mr. Brande was to find such combinations of the colouring matter as would be insoluble, and might therefore afford a permanent dye. When combined with alumina it is red while moist, but becomes brown when dried. With oxide of tin it may also be combined, but becomes of a dull red by drying; neither does supertartrate of potash give permanent brilliancy to the colour. But when a piece of calico has been previously dipped into infusion of oak-bark, and afterwards steeped in an alkaline solution of the colouring matter, it acquires a redness nearly equal to that given by madder, and tolerably permanent. But the most effectual mordants appeared to be some of the solutions of quicksilver. Pieces of woollen cloth, calico, or linen, steeped first in a solution of corrosive sublimate, and afterwards in a solution of the colouring matter, acquired a permanent red tinge, which remained unaltered by washing with soap.

The author has, therefore, considerable hopes that this substance may be of some utility in the art of dyeing; and he remarks, that blood has, in fact, been already employed by the Armenian dyers, along with madder, to ensure the permanency of the colour.

Observations of a Comet, with Remarks on the Construction of its different Parts. By William Herschel, *LL.D. F.R.S.* Read December 19, 1811. [*Phil. Trans.* 1812, *p.* 115.]

The author first gives us, in detail, the succession of appearances that he has observed respecting this comet and its various parts, consisting of a planetary body, perceptible only by the best telescopes, in the luminous spherical head, which to the naked eye appears as a nucleus. The head is surrounded by an envelope that is hemispherical on the side towards the sun, but extends in an opposite direc-

tion in the form of a very long cone of light, called the tail of the comet.

The planetary body was at no time perceptibly otherwise than circular. Its apparent magnitude was about three quarters of a second, and its real diameter is estimated at 428 miles. The position of this body never appeared to be in the centre of the head, but to be more or less eccentric at different periods of observation, but always more remote than the centre from the sun.

Nevertheless, the greatest illumination of the surrounding head is represented by Dr. Herschel as greatest in the centre, and in its decrease from thence to be somewhat brighter on the side toward the sun than at the part occupied by the planetary body. The apparent magnitude of the head was found to measure $3\frac{3}{4}$ minutes; so that its real magnitude is estimated to have been 127,000 miles.

Between the head and the surrounding envelope there was a space comparatively dark, which Dr. Herschel imagines to be filled with an elastic atmosphere, and estimates its actual extent to be at least 507,000 miles, since its apparent diameter was nearly 15 minutes of a degree.

The train of light, to which Dr. Herschel gives the name of envelope, from its surrounding the head on one side in a semicircular form, was found to measure 19 minutes of a degree in diameter, and was thence inferred to be 643,000 miles in real extent.

The two extremities of this curve being continued beyond the head in two streams of light, rather divergent from each other, form the appearance which is called the tail. The distance to which this appears to reach from the head varied on different nights, according to the state of the atmosphere, as well as from other circumstances which affected its actual length. The greatest length observed by Dr. Herschel was on the 6th of October, when he measured it $25°$; but he thinks the measure of $23\frac{1}{2}°$, taken on the 15th of October, more to be depended upon; and he thence computes the actual length to have been at that time 100,000,000 of miles.

With respect to the curvature of the tail, Dr. Herschel remarks, that it varied not only in degree, but in direction; for on the 2nd of December he observed that it appeared convex on the following side, as if the extremity of the tail preceded the head instead of being left behind.

The author also notices many other irregular appearances of the tail, the branches on each side occasionally dividing into two or three parts, and sometimes one branch, sometimes the other, seemed longest.

From the appearances observed, Dr. Herschel next infers what is the real construction of the various parts. And, first, the planetary body seems to be spherical, as might be expected from the common laws of gravitation, and to shine by light of its own; for if it were not so, it must have appeared to change its figure in moving as it did through more than a quadrant while it remained visible. The head also must, for the same reason, be spherical: and so likewise that portion of the envelope which is on the side towards the sun

must be hemispherical; for if it were merely a band of light, all in the same plane, its phases must have varied like the ring of Saturn. This cap must also be comparatively thin, since the parts at a distance from its edge, which were therefore seen transversely, appeared dark in comparison to the circumference, where a greater quantity of luminous matter was seen by oblique vision. And it is to the same cause that the comparative brightness of the edges of the tail is ascribed by Dr. Herschel.

With respect to the production of some of the cometic phenomena, the author conjectures, that the light is of a phosphoric nature; that the luminous matter of the head, being expanded on one side by the action of the sun, occupies more space, and consequently occasions the planetary body to appear eccentric; that part of this matter, being greatly rarified, ascends in the cometic atmosphere till it occupies the surface of that medium on the side towards the sun, and forms the hemispherical part of the envelope. He next supposes a further attenuation and a decomposition of this matter, till its particles are sufficiently minute to receive a slow motion from the impulse of the solar beams, and consequently *gradually* to recede in a direction towards the region of the fixed stars, to the distance of 100,000,000 miles.

From the escape of such a quantity of light, and probably of other subtile elastic matters, in consequence of the comet's near approach to the sun, Dr. Herschel infers that a greater consolidation of the remaining solid matter of the comet takes place at the time of its perihelion passage. He further thinks it not unlikely that the matter they contain is derived from nebulæ, which they meet with in the extensive orbits they describe; that in their course they visit other suns beside our own; and at each successive approach to these various centres they undergo progressive condensation; from which we may conceive how other planetary bodies may begin to have existence.

On a gaseous Compound of carbonic Oxide and Chlorine. By John Davy, *Esq. Communicated by Sir* Humphry Davy, *Knt. LL.D. Sec. R.S.* Read February 6, 1812. [*Phil. Trans.* 1812, *p.* 144.]

Although it has been asserted by Messrs. Gay-Lussac and Thenard, and also by Mr. Murray, that carbonic acid and chlorine have no action upon each other, Mr. J. Davy has observed the contrary to be the case. A mixture of equal parts of these gases, previously dried over mercury, being exposed to bright sunshine for about one quarter of an hour, lost all colour of the chloric gas, and were found condensed into half their former volume. The smell of this gas was more suffocating than that of chlorine. It occasioned a very painful sensation in the eyes; it reddened litmus paper; it combined with ammonia, forming a salt perfectly neutral and dry, but deliquescent by attracting moisture from the atmosphere. This salt was decomposed by sulphuric, nitric, and phosphoric acids, and also by liquid muriatic